

first intensely black first ring, fainter stars telescopically show smaller disks.

But whilst a close row of spurious disks are seen to coalesce and obliterate themselves if too close, and become continuous as a thick luminous line—the necessary effect of bright diffractions—duller objects devoid of brilliance are seen of amazing minuteness of tracery.

*Example.*—The rungs or rounds of a ladder resting against a house half a mile off were distinctly seen when miniaturised down to 1-1,000,000th of their actual size, *i.e.* considerably less than 1-1,000,000th of an inch. This feat was accomplished by an immersion 1-32nd by Seibert, which diminishes an object 30,000 inches away just about 1,000,000 times. The bane of minute microscopic research is thus seen to essentially consist of a combination of diffraction with the haze of aberration.

A blue glass evidently diminishes the diffraction phenomena; so do neutral tints. This exactly

tallies with the shrinking of spurious telescopic disks during haze and sky-clouding. These facts forcibly point out the great advantages of observing in mild light. In further support of this the writer has thus effected several very difficult resolutions—in the “Ultima Thule” of microscopic investigation glare is the prolific parent of many fallacious interpretations.

These studies have encouraged the writer to continue a research into the limits of human microscopic vision. In the case of bright illuminations the limit is evidently reached at once. A minute refracting spherule thus forms a bright focal point which itself exceeds by expansion into a spurious disk, the diameter of the spherule producing it. Down to a certain size a focal image is discernible. A very interesting study is given by the solar star-disks presented by receiving the rays from the heliostat after passing through a beetle's eye placed on the field of view on the stage of the microscope.

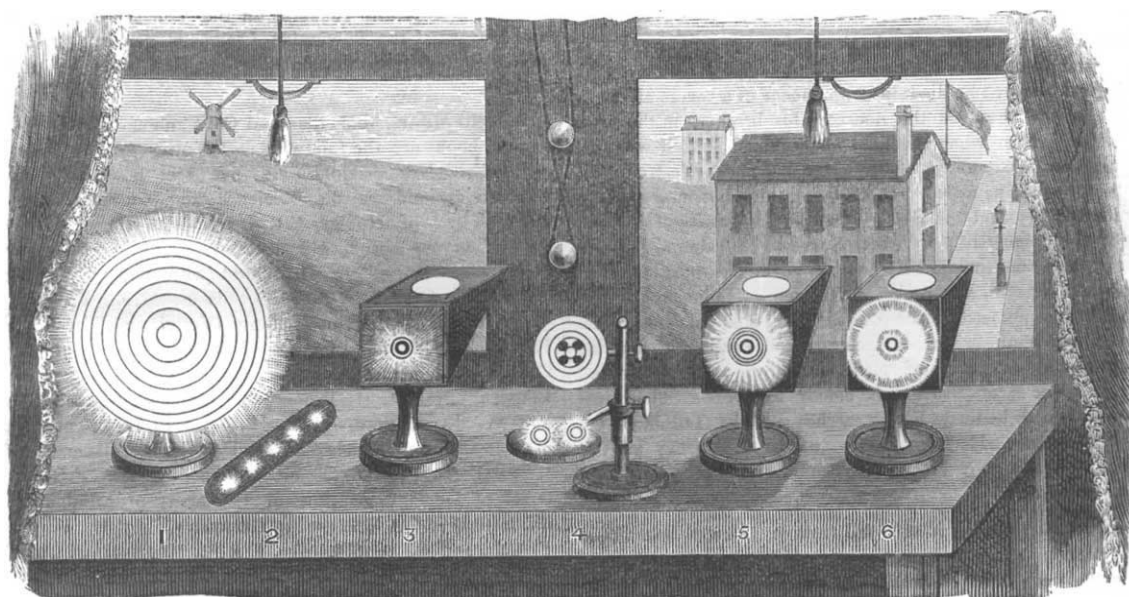


FIG. 1.—Taking the objects from, left to right, a representation is given of a miniature magnified a thousand times linear and the various appearances of the heliostatic star disks with slight changes of focussing. 1. Large diffraction rings: *fundamental spectrum* given by a plane convex lens  $\frac{1}{4}$  inch focal length placed on stage of microscope. Forty rings have been counted. 2. Optical gauge: various lenses showing spurious disks with minute diffraction rings similar to those on the “bulls-eye” in centre of picture. 3. Intensely clear bright star disk produced by very perfect instrumentation. 4. A cross given by imperfect glasses. 5. Larger expanding rings, the miniature or observing glasses being either under or over-corrected. 6. The finest and clearest spurious disk attainable.

NOTE.—The house on the hill distinctly seen in this case of very finely corrected glasses. A miniature formed by a very fine 1-32nd gives the distant house and window nearly in the same focal plane.

Until the sun shone the window appeared miniaturised in each eye. It seems curious to measure the focal length. By measuring the images this was found to be 1-1000th of an inch, giving enormous magnification for ordinary vision.<sup>1</sup> The solar disk, however, appeared spuriously enlarged.

More wonderful diffraction-phenomena are developed by different treatment. A half inch condenser-objective was inserted between the coleopterous eyes and the heliostat—behind or beyond the stage. The solar disks developed then appeared severely beautiful. No such

wonderfully sharp black rings are even viewed telescopically. These phenomena are in order of focal lengths—

1. Intensely black truly formed rings.
2. Hexagonal black patterns on a brilliant ground.
3. Three such hexagonal rings to each eye-facet.
4. Five such finished off with extremely rich Scotch plaid patterns, highly coloured.

G. W. ROYSTON-PIGOTT

#### NOTES

THE Delegates of the Clarendon Press will shortly publish an “Elementary Treatise on Electricity,” by the late Prof. James Clerk Maxwell, edited by Mr. W. Garnett, formerly Fellow of St. John's College, Cambridge. The book was commenced about seven years ago, but its completion was prevented by the author's other engagements; so that during the last three years of his life very little was added to the work. After his death the first portion of the manuscript, on Statical Electricity, was

<sup>1</sup> Their focal length was measured by selecting a well-defined object, as a red brick house, carefully measuring micrometrically a given part of it, and then measuring an image of the same thing in a known lens.

If  $d$  be the distance of the object from its image,  $m$  the size of its miniature,  $M$  the size of the object,

$$f = d \times m \div M.$$

A convenient formula for estimating the focal length of a small lens was given by me in the *Phil. Trans.* If it is found to magnify  $m$  times at a distance between object and image  $d$ , and if  $m$  be considerable,

$$f = \frac{d}{m+2}, \text{ more accurately } = \frac{d}{m + \frac{1}{m} + 2}.$$

found in a finished state, as well as some chapters on Current Electricity. The book has been completed so as to cover the subjects included in the first volume of the larger Treatise on Electricity and Magnetism by a selection of some of the simpler articles from the last-mentioned work. As in the larger treatise, the "method of Faraday" has been followed throughout; but no knowledge of the higher mathematics has been assumed, and geometrical methods have been almost everywhere adopted. Very much of the matter contained in the work will, we are informed, be new to readers who had not the advantage of attending Prof. Maxwell's lectures at Cambridge, and the whole book bears indelibly the stamp of Prof. Maxwell's originality. It is as much unlike any other book on electricity as the "Theory of Heat" or "Matter and Motion" is unlike other books on thermodynamics or mechanics. The Clarendon Press likewise have nearly ready for publication a second edition of Prof. Clerk Maxwell's "Treatise on Electricity and Magnetism," edited by Mr. W. D. Niven, Fellow of Trinity College, Cambridge.

WE regret to announce the death, at the age of forty years, of Dr. Gustaf Linnarsson, the able palæontologist to the Swedish Geological Survey; he died, in consequence of a severe attack of disease of the chest, at the house of his brother, in the town of Sköfde. Even when at school he occupied himself with the geology and palæontology of his native province, Westrogothia. He took his degree as M.A. in 1866 with high honours, and was nominated "Docent" in Geology at the University of Upsala. In 1870 he joined the Geological Survey of Sweden as palæontologist, and since that time has worked at the classification of the Cambrian and Silurian rocks of Sweden. He has expounded his views in a numerous series of geological and palæontological papers, which all prove his accuracy and caution in drawing conclusions. The now adopted classification of the oldest Palæozoic rocks of Sweden is chiefly his work. The fossil groups in which he made his researches are the Trilobites and the Graptolites. His premature decease is a heavy loss to science, the more so as he has left behind him several important works unfinished.

THE death, resulting from a fall from a horse, is announced of Frederick Joy Pirani, lecturer on Natural Philosophy and Logic at Melbourne University. Mr. Pirani was born in Birmingham in 1850, but went to Victoria when a boy, and was there educated. He was an accomplished mathematician, and gave promise of future eminence. He was active in the promotion of science in the Colony. Mr. Pirani was an occasional contributor to our pages.

AT the last general assembly of the Swiss Alpine Club Mr. Whympers was elected honorary member, "in recognition of his having contributed, as few other travellers have done, to the exploration and renown of the Alps."

THE introductory lecture for the present Session at University College in the Faculty of Science and Arts will be given by Prof. Bonney, F.R.S., on Tuesday, October 4, at 3 p.m., in the Botanical Theatre. The subject will be "A Chapter in the Life-history of an Old University," or a sketch of the chief changes, educational and social, at Cambridge during about the last hundred years. The lecture is open to the public without tickets.

MESSRS. SAMPSON LOW AND CO. announce the following books for the forthcoming season:—"The Head Hunters of Borneo: Up the Mahakkam and Down the Barita; also Journeys in Sumatra," by Carl Bock; "Uganda and the Egyptian Soudan: an Account of Travel in Eastern and Equatorial Africa; including a Residence of Two Years at the Court of King Mtesa, and a Description of the Slave Districts of Bahr-el-Ghazel and Darfour. With a new Map of 1200 miles in these

Provinces, numerous Illustrations, and Anthropological, Meteorological, and Geographical Notes," by R. W. Felkin, F.R.G.S., and the Rev. C. T. Wilson, M.A. Oxon., F.R.G.S.; "Magyarland: A Narrative of Travels through the Snowy Carpathians, and Great Alföld of the Magyar," by a Fellow of the Carpathian Society (Diploma of 1881), and author of "The Indian Alps"; "Through Siberia": illustrated with about thirty engravings, two route maps, and photograph of the author, in fishskin costume of the Gilyaks on the Lower Amur, by Henry Lansdell; "Nordenskjöld's Voyage around Asia and Europe: a Popular Account of the North-East Passage of the *Vega*," by Lieut. A. Høygaard, of the Royal Danish Navy, and Member of the *Vega* Expedition; "South by East: a Descriptive Record of Four Years of Travel in the Less Known Countries and Islands of the Southern and Eastern Hemispheres," by Walter Coote; "Upolu; or, A Paradise of the Gods: being a Description of the Antiquities of the Chief Island of the Samoan Group, with Remarks on the Topography, Ethnology, and History of the Polynesian Islands in general," by the late Handley Bathurst Sterndale, edited and annotated by his brother.

AMONG MESSRS. Macmillan and Co.'s announcements of forthcoming books are the following:—"Voyage of the *Vega*," by Adolf Erik Nordenskjöld (with five steel portraits, numerous illustrations, and maps); "Science and Culture, and other Essays," by Prof. Huxley, F.R.S.; Charles Kingsley's "Water Babies" (a new edition, with illustrations by Linley Sambourne); "Origines Celticae," by Dr. Guest (with maps); "Physics of the Earth's Crust," by Rev. O. Fisher, M.A., F.G.S.; "A Course of Instruction in Zootomy (Vertebrata)," by T. Jeffrey Parker, B.Sc. Lond., Professor of Biology in the University of Otago; "Elementary Lessons in the Science of Agricultural Practice," by Prof. H. Tanner; "Mathematical Papers," by the late W. K. Clifford, M.A., F.R.S., Professor of Applied Mathematics and Mechanics at University College, London; "Text-Book of Geology," by Archibald Geikie, F.R.S., Professor of Geology, &c., in the University of Edinburgh (with illustrations); "A Treatise on Chemistry," by H. E. Roscoe, F.R.S., and C. Schorlemmer, F.R.S., Professors of Chemistry in the Victoria University, Owens College, Manchester (with illustrations): Vol. III. "The Chemistry of the Hydrocarbons and their Derivatives, or Organic Chemistry," Part I.; "Further Steps in the Principles of Agriculture," by Prof. Tanner; "The Organic Method of Studying Languages," by G. Eugène-Fasnacht; "Electricity and Magnetism," by Prof. Silvanus P. Thompson (illustrated).

MR. B. SAMUELSON, M.P., F.R.S., the chairman of the Royal Commission on Technical Instruction, has returned from a visit to Berlin, where, through the courtesy of our Ambassador, Lord Ampthill, he has secured the assistance and co-operation of the German authorities in the collection of preliminary information bearing on the subject of the inquiry. He has also made arrangements for the forthcoming visit of the Commissioners to the manufacturing districts of Westphalia. At the first meeting of the Royal Commission it was resolved that among the points to be examined should be the instruction afforded on the Continent to the proprietors and superior managers, the foremen, and the workpeople engaged in industrial pursuits, and that investigation should also be made into the connection between general and technical instruction, and the sources of the funds from which such instruction is defrayed.

THE last field meeting of the year of the Woolhope Naturalists' Field Club, we learn from the *Gardeners' Chronicle*, will be held at Hereford, on Thursday, October 6, for a foray among the funguses. There will be an exhibition of funguses in the museum room at the Free Library, and an evening meeting will



be held there on Wednesday, October 5, at 8 p.m., to name and study them. The foray will be made in Stoke Edith Park and grounds, by the kind permission of Lady Emily Foley. A meeting of the members will be held in the Woolhope Club-room at 3.45 to elect the officers for the ensuing year, and to transact the ordinary business of the Club. The dinner will take place at the Green Dragon Hotel at 4.30 p.m., and a *soirée* will be held at the house of Mr. Thomas Cam at 8 p.m., to which he kindly invites all who may be present at the meeting. After dinner, or at the evening meetings, papers will be read on the following subjects:—The progress of mycology, by Dr. Bull; fungus mimics, by M. C. Cooke, M.A., LL.D., &c.; the Herefordshire Carices, by the President of the Club; the fungi of the Dolomites, by Thomas Howse, F.L.S., &c.; the fungi which attack the wheat, by the Rev. John E. Vize, M.A.; the germination of the Uredines, and the relationship of *Aecidium verberidis* to *Puccinia graminis*, by Mr. C. B. Plowright; *Protococcus*, by the Rev. John E. Vize, M.A.; monstrosities in fungi, by W. Phillips, F.L.S., and a curious and abnormal cellar *Polyporus* will be shown by Mr. Phillips; two tomato diseases, by C. B. Plowright. The Pomona Committee of the Club have decided to hold an exhibition of apples and pears on Wednesday and Thursday, October 26 and 27, and schedules of the prizes offered may be obtained from the hon. secretaries, Woolhope Club-room, Free Library, Hereford.

ALL who have to consult or translate from French scientific and technical works will welcome Dr. F. J. Wershoven's "Technical Vocabulary, English-French, for Scientific, Technical, and Industrial Students" (Hachette and Co.). The vocabulary is arranged according to subjects, beginning with general notions on matter, and going on to force and motion, gravity, and other subjects in physics, mechanics, and chemistry, and their applications, and giving all the words and phrases in use in regular order. An ample alphabetical index renders the vocabulary easy of consultation. There is also an English-German edition.

MR. A. TREVOR CRISPIN, writing from Hyde End House, Brompton, Reading, sends us the following information:—He is staying with his brother-in-law, Capt. Johnston, and the other morning, as usual, Capt. Johnston had had a cut fluted tumbler brought to his dressing-room filled with milk warm from the cow; into this a small quantity of rum was put, and the whole left standing. While Capt. Johnston was having his bath there was a loud noise, and on looking round he found the tumbler had parted in two, and there was an interval of four or five inches between the two parts. The fracture commences near the top (and the circumference at the top remains unbroken), at the very line of the level of the milk, the mark of which remained quite distinctly on the glass. This was the second occurrence of a precisely similar nature, the first having taken place about a month ago; but then the fracture took place some minutes after the contents of the glass had been consumed.

WE learn from the *Bulletin* of the Physical Observatory at Tiflis, that on August 24, at 11.18 p.m., there was felt in that town an earthquake which consisted of three shocks, direction from north-east to south-west. The same earthquake was felt at Gori at 11.9, at Kutais at 11.40, the direction being from east to west; at the station Kobi of the military route at 11.27, the direction being north-west to south-east; and at Gomi, a station of the Poti and Tiflis railway, where it lasted for about twenty-five seconds.

AN earthquake shock, very slight in this neighbourhood, but stronger further east, was felt in the basin of the Lake of Geneva on Friday. The earthquake was followed by a violent thunder-

storm, which seemed to extend from the Alps to the Jura. Several vessels were wrecked and some lives were lost on the Lake of Brienz. A village in the district of Albula is threatened with a disaster similar to that which has just befallen Elm. The village lies at the foot of the Rothorn, a mountain in which there are several deep fissures, a part of which has been actually in movement for some time. Several engineers have already inspected the locality, and the intervention of the Federal and Cantonal Governments is demanded, in order that, if possible, measures may be taken to avert the impending peril.

A SHOCK of earthquake occurred on September 25 at Elmira, State of New York, followed by a destructive hurricane, which was, however, of short duration. On Thursday last, at noon, further shocks of earthquake alarmed the inhabitants of Orsogna, Lanciano, and Castel Frentano, where a landslide did serious damage.

THE Calendar of the Mason College, Birmingham (which has already attained considerable thickness), for the ensuing session contains a very satisfactory programme of the teaching promised by this institution. The session opens on Tuesday next with two introductory addresses, by Prof. R. H. Smith (Civil and Mechanical Engineering), and Prof. Edward Arber (English Literature).

MR. J. W. SWAN, the *Photographic News* states, has entered into an amicable arrangement with Messrs. Siemens Brothers the well-known electricians—they to employ his lamp, and he to use their apparatus. In company, they are to light up the new theatre in Beaufort Buildings with electricity, three hundred of Mr. Swan's lamps being used on the stage and in the auditorium. At the Paris Electrical Exhibition they are making a fuss over the model of a theatre lit up by electricity; in London we shall have the real thing.

M. FERRY, French Minister of Public Instruction, has authorised the opening at Montpellier of the first national college for the education of females.

THE Jamaica Government are offering great advantages to those who are inclined to embark in the cultivation of Cinchona. Suitable land is offered at a very low rate, and it seems to us that, with proper methods and selection of the right kind of plants, there is room in Jamaica for a limited number of plantations of this kind. In connection with this, Mr. D. Morris has issued a valuable series of "Hints and Suggestions for Raising Cinchona plants from seeds, and establishing Cinchona plantations."

"PROFITABLE and Economical Poultry-Keeping," by Mrs. Eliot James, is a useful little work, published by Ward, Lock, and Co.

WE have received the Reports of the Leicester and Nottingham Literary and Philosophical Societies. The former is divided into various science sections, each of which seems efficient. The Leicester Society is printing a record of its early *Transactions*, part vii. extending from June 1860 to June 1865.

A PROPOSITION has just been set on foot for an exhibition of naval and submarine engineering appliances, which is to be held in the early part of next year at the Agricultural Hall, Islington. It is intended to cover the wide field occupied in the production of machinery and mechanical contrivances employed in, or connected with, the construction and equipment of ships of all classes.

MESSRS. GRAS AND CO. of Madrid announce the publication of a Popular Illustrated Encyclopædia of Science and Art, edited by Mr. F. Gillman, mining engineer. It seems to be modelled on the German *Conversations lexicon*, though, to judge from the

prospectus, the work will be arranged according to subjects, and not alphabetically.

NOWHERE, according to Prof. Porter, President of Queen's College, Belfast, is the vital importance to the nation of technical education more keenly felt than amongst the merchants and manufacturers of Ulster. "Germany" (observes the same authority) "provides buildings, laboratories, and scientific apparatus on the most liberal scale. In France, Belgium, Switzerland, and the United States of America, higher technical education is making rapid strides under the fostering care of the respective Governments, aided by the generous contributions of patriotic citizens. The results of this wise liberality, while enriching those nations, are most seriously affecting the manufacturing interests of this country, and especially of Belfast and Ulster." Prof. Porter considers that in order fully to develop the latent resources of that part of Ireland we must have the means of giving young men a scientific training.

IN the *Bulletin* of the Essex (U.S.) Institute for April, May, and June is a paper by the Rev. G. F. Wright, on the Glacial Phenomena of North America, and their Relation to the question of Man's Antiquity in the Valley of the Delaware.

THE additions to the Zoological Society's Gardens during the past week include two Bonnet Monkeys (*Macacus radiatus*) from India, presented respectively by Mr. J. Thompson and Mr. C. Green; a Macaque Monkey (*Macacus cynomolgus*) from India, presented by Mr. W. Thomson; a Banded Ichneumon (*Herpestes fasciatus*) from West Africa, presented by Mr. W. Cubitt; two Common Otters (*Lutra vulgaris*) from Ross-shire, N.B., presented by Mr. H. Mitchell; a Black-crested Eagle (*Lophoœtus occipitalis*) from Africa, presented by Mr. E. A. Harland; a Brush Turkey (*Talegalla lathamii*) from Australia, presented by Capt. F. M. Burke, s.s. *Cheybassa*; a Red-legged Partridge (*Caccabis rufa*), European, presented by Mr. J. E. Clayton; a Common Cuckoo (*Cuculus canorus*), British, presented by Master Alfred Beart; an American Black Bear (*Ursus americanus*) from North America, deposited; four Zebra Waxbills (*Estrelia subflava*) from Africa, purchased; a Collared Fruit Bat (*Cynonycteris collaris*), three Undulated Grass Parakeets (*Melopsittacus undulatus*), bred in the Gardens. The additions to the Insectarium include larvæ of the Comma Butterfly (*Vanessa C. album*), scarce Swallow-tail Butterfly (*Papilio podalirius*), and Privet Hawk-Moth (*Sphinx ligustri*). Also imagos of *Ranatra linearis*, and a specimen of *Attacus atlas* reared from larvæ hatched in the House.

### OUR ASTRONOMICAL COLUMN

THE SATELLITES OF MARS.—The approaching opposition of this planet does not hold out much probability of satisfactory observations of the satellites except with the larger instruments, though in European latitudes the meridian altitude, which is an element in the case, will be considerable. Taking Prof. Asaph Hall's unit for brightness in 1877, viz. that on October 1, when the outer satellite was seen with the 9.6-inch equatorial of the Naval Observatory, Washington, we find the maximum brightness at the next opposition will be represented by 0.4, which is a less value than corresponds to the last date of observation with the 26-inch refractor at the same observatory. It may be remembered that Mr. Common observed *Deimos* on the morning of September 2, 1879, without much difficulty with his reflector of 3-feet aperture, when the degree of brightness in terms of Prof. Hall's unit was 0.50; at the last Washington observation in 1879 it was 0.52. The earth being only about 10° from the line of nodes of the satellites' orbits at the opposition in December next, their apparent paths are reduced almost to straight lines. The longitude of the ascending node of *Deimos* is 88°.

THE SATELLITES OF SATURN.—Mr. Marth has again prepared ephemerides of the five inner satellites of Saturn, which have been published in the *Astronomische Nachrichten*; he appends differences of right ascension between the outer satellite,

*Japetus*, and the centre of Saturn, but he does not attack *Hyperion*. Preceding the ephemerides are auxiliary quantities for every fifth noon at Greenwich, by means of which the positions of the five inner satellites may be determined for any time required from the formulæ—

$$s \sin (\phi - P) = a \sin (l - L) \\ s \cos (\phi - P) = b \cos (l - L).$$

Here  $\phi$  is the angle of position with reference to the planet's centre, and  $s$  the distance therefrom; the values of  $(l - L)$  and of the semi-axis  $a$  and  $b$  are tabulated for each satellite, as well as the angle  $P$ , which is applicable to all five. The process is simple enough to any one initiated in such calculations, but as there may be observers to whom they are unfamiliar, an example may not be out of place here.

Let it be required to determine from Mr. Marth's tables the angle of position and distance of *Mimas*, at Greenwich midnight, on October 1. We have then—

|                            |                      |                                     |                    |     |         |
|----------------------------|----------------------|-------------------------------------|--------------------|-----|---------|
| $(l - L)$ Oct. 1d. oh. ... | 287° 60              | log $a$ ...                         | ...                | ... | +1.4856 |
| Motion in 12h. ...         | 191° 04              | sin $(l - L)$ ...                   | ...                | ... | +9.9433 |
| $l - L$ ...                | ...                  | 118° 64                             | Call the sum A ... | ... | +1.4289 |
| From the tables {          | $P = 359^{\circ} 58$ | log $b$ ...                         | ...                | ... | -1.0128 |
|                            | $a = 30'' 59$        | cos $(l - L)$ ...                   | ...                | ... | -9.6806 |
|                            | $b = -10'' 30$       | Call the sum B ...                  | ...                | ... | +0.6934 |
|                            |                      | $\frac{A}{B} = \tan (\phi - P) ...$ | ...                | ... | +0.7355 |
|                            |                      | $\phi - P$ ...                      | ...                | ... | 79° 58  |
|                            |                      | Add $\phi$ ...                      | ...                | ... | 359° 58 |
|                            |                      | $\phi$ ...                          | ...                | ... | 79° 16  |
|                            |                      | sin $(\phi - P)$ ...                | ...                | ... | +9.9928 |
|                            |                      | $\frac{A}{\sin (\phi - P)}$ ...     | ...                | ... | 1.4361  |
|                            |                      | $s$ ...                             | ...                | ... | 27'' 30 |

THE FOURTH COMET OF 1874.—Dr. Holetschek, of the Observatory of Vienna, has investigated definitive elements of this comet, which was discovered on August 19, 1874, by M. Coggia at Marseilles. He uses four normal places: for August 21, September 18, October 10, and November 9. For the later normals we presume he will have made use of a fine series of observations made with Col. Tomline's 10-inch refractor at the Orwell Park Observatory, near Ipswich, by Mr. J. I. Plummer, which extends, we believe, considerably beyond observations published so far from other observatories. With Col. Tomline's refractor the comet was followed until the middle of November, and great care appears to have been taken with the observations and reductions. They form one of the very best series that has obtained for some years at an English observatory. Dr. Holetschek infers that the comet was moving in an elliptic orbit with a period of about 300 years. His orbit is as follows:—

Perihelion Passage, 1874, July 17.68463, Greenwich M.T.

|                              |     |              |                   |
|------------------------------|-----|--------------|-------------------|
| Longitude of perihelion ...  | ... | 5 26 13      | } M. Eq. 1874° 0. |
| ascending node ...           | ... | 215 50 47    |                   |
| Inclination ...              | ... | 34 7 54      |                   |
| Excentricity ...             | ... | 0.9622257    |                   |
| Log. perihelion distance ... | ... | 0.227275     |                   |
| Semi-axis major ...          | ... | 44.671       |                   |
| Period of revolution ...     | ... | 298.6 years. |                   |

The comet with these elements might approach pretty near to the planet Uranus near the ascending node, but we might rather look to an encounter with Mars at the opposite node as the cause of ellipticity of orbit, the radii-vectores being there identical, with but small difference of latitude.

ANCIENT STAR-POSITIONS.—In the *Vierteljahrsschrift der Astronomische Gesellschaft*, 16 Jahrgang, Dr. O. Danckwortt has tabulated the positions of forty-six fundamental stars of the *Berliner Jahrbuch* for the commencement of each century from -2000 to +1800. He adopts Leverrier's precession constants for 1850, and takes account of the proper motions. The tables are preceded by a discussion of formulæ and comparison of constants which will be of service to any one who may have